

## 2012 Funded Section 6 Plant Proposals

The following proposals were funded in 2012 (Segment 16). Federal shares include Arizona Department of Agriculture administration costs.

### 1) **Research on Arizona rare and endangered plants: program facilitation and rare plant list development**

Principal Investigator(s): **Dr. Michelle McMahon, University of Arizona Herbarium**  
Federal Share: \$6,767

Objective(s): (1) Continue participation in Section 6 program by advertising the program on the UofA Herbarium website, providing scientific review of proposals, interim reports, and final reports, and to facilitate researcher's access to herbarium specimens in our facility or through loans with other herbaria. (2) Participate in the development and growth of a regional, curated, rare plant list to be published for viewing by the public. Funds are sought here to support a part-time student who will assist staff (already funded elsewhere) in these endeavors. The student employee will gather literature and add data to the database under the supervision of project staff.

Final Report Abstract: Participation in the section 6 program continued through the advertisement, solicitation, and processing of section 6 proposals; scientific review of interim and final section 6 reports; and work with the Rare Plant Alliance to expand a state-based list from ~700 taxa to more than 1,100 taxa of conservation concern from the region.

### 2) **Abundance, seed production and seedling establishment of *Amsonia kearneyana***

Principal Investigator(s): **Dr. Juliet Stromberg, Arizona State University**  
Federal Share: \$20,200

Objective(s): (1) Assess current population size of *Amsonia kearneyana*. (2) Quantify flower and seed production of adult plants in relationship to plant size. (3) Describe soil properties of an extant population, with respect to particle size, moisture, and temperature. (4) Determine how seed germination, seedling growth and seed survivorship vary in response to soil traits and to seed burial depth.

Final Report Abstract: We located and georeferenced 43 individual plants in the Upper Brown Canyon A population, but believe the sub-population contains approximately 68 individuals (some were inaccessible and some may have been missed). The plant found in 2012 some 102 meters away was relocated and an area 50m<sup>2</sup> searched for more individuals; none were located. Within the Upper Brown Canyon B population, 128 plants were georeferenced and another 150 plants could be seen across the canyon in an inaccessible location. We approximate the total Upper Brown Canyon population to be 346 individuals. Five individuals were located in Lower Brown Canyon at the reintroduction site. No plants were located in Thomas Canyon, though the exact location where they were previously located was not visited in this survey. Habitat descriptions are made; germination trials found that no plant germinated in native soil and 14 or 50 seeds germinated in potting soil; scarification, soaking, or cold stratification is not required for germination. Seeds on the surface of the soil germinated more readily than those buried various depths.

**3) Survey and census of Lemmon's fleabane (*Erigeron lemmonii*) in the Huachuca Mts., Arizona**

Principal Investigator(s): **Dr. Jim Malusa, University of Arizona**

Federal Share: \$1,667

Objective(s): (1) Census the permanent monitoring plots in Scheelite Canyon (for the first time since set-up in 2006), and (2) Extend the survey into Garden Canyon to assess the total population of *E. lemmonii*.

Final Report Abstract: The re-census of the permanent plots found that two of the original 58 plants had died. Six recruits had established, too, for a net gain of four plants, bringing the total census population to 62. No new populations of *Erigeron lemmonii* were found in appropriate habitat of nearby canyons.

**4) Surveys of *Echinomastus erectocentrus* var. *acunensis* in northwestern Sonora**

Principal Investigator(s): **Dr. Thomas R. Van Devender, Sky Island Institute**

Federal Share: \$26,213

Objective(s): (1) Assess the distribution, abundance, and status (including threats) of *E. e.* var. *acunensis* in northwestern Sonora through field surveys, (2) Record other plants encountered during the surveys. Field activities and collections will be made under a Mexican collecting permit to J. Jesús Sánchez-Escalante, a collaborator and the Curator of USON. These observations and collections will be available in the online Madrean Archipelago Biodiversity Assessment (MABA) database (Madrean.org).

Final Report Abstract: Surveys were conducted in the Arizona upland Sonoran desertscrub habitats on granitic ridges, slopes, and bajadas in the Sonoyta area in the Municipio de General Plutarco Elías Calles of Sonora, Mexico. Additional observations were made on population characteristics, reproduction, habitat, vegetation, and associated plants. A total of 1,549 individuals were located; of these 655 were living. An additional 27 transects of 0.1 km<sup>2</sup> in potential habitat were done without finding acuña cactus.

**5) Emergency actions to determine recent declines in the endangered *Pediocactus bradyi***

Principal Investigator(s): **Dr. Kristin Haskins, Arboretum at Flagstaff; Dr. John Spence, Northern Arizona University; Dr. Todd Esque, U.S. Geological Survey; Andrea Hazelton, Navajo Nation Natural Heritage Program**

Federal Share: \$15,607

Objective(s): There is an urgent need to determine why this species is declining, and whether new populations can be established in apparently suitable un-occupied habitat. There are seven principal objectives of this project, and an optional 8<sup>th</sup> objective: (1) Complete surveys in potential habitat to provide a reasonable estimate of the total population size; This will be done using GIS data layers and sampling of randomly selected points in known potential habitat. The NPS will complete this sampling prior to field work. (2) Characterize and document the invasive exotic plant species associated with known *P. bradyi* populations, to

be included in population monitoring. (3) Develop a uniform integrated monitoring program that follows the fates of individuals across the species range. (4) Conduct additional biological work on pollination ecology and seed viability. (5) Compile existing and new data and prepare a status report. (6) Provide data to the USFWS to support completion the 5-year status review. (7) Analyze long-term population trends over the last 25 years on BLM plots to determine stochastic growth rates. (8\*) Optional: Seed Transplant Experiment.

Final Report Abstract: NPS established a new plot in April 2013, and sampled an additional 50+ individuals. One new location was discovered on the Navajo Nation following surveys focused on locations with the greatest chance of finding enough cacti that seed could be collected. Exotic plants were surveyed in the vicinity of *Pediocactus* locations. The distance estimation method was tested for an individual walking a transect line at increasing distances. Visual detection of blooming plants was most accurate at under 3 meters per side. No pollination events were observed due to poor weather conditions. Viability of seed collected in 2013 was found to be high; germination rates were much lower. Additional methods of germination will be tested.

**6) Identifying reproductive barriers to geographic relocation as a conservation strategy for *Echinocereus* spp.**

Principal Investigator(s): **Dr. Clare Aslan, Sonoran Desert Museum**  
Federal Share: \$21,153

Objective(s): Identify geographic patterns of and likely limitations to Arizona hedgehog pollination and reproduction through (1) Identify pollination phenology and relative frequencies and efficiencies of pollinators across an elevational gradient in natural populations of both *Echinocereus coccineus* and *E. triglochidiatus*. (2) Identify pollination phenology and relative frequencies and efficiencies of pollinators in transplanted populations of both *Echinocereus coccineus* and *E. triglochidiatus*. (3) Quantify pollinator abundances during the flowering season in sites containing natural and transplanted populations of both *Echinocereus* species. (4) Assess early reproductive metrics in both natural and transplanted populations of both *Echinocereus* spp. (seed production, seed viability, seedling occurrence).

Final Report Abstract: I examined pollination and reproduction among wild and relocated individuals of Arizona hedgehog cactus (*Echinocereus arizonicus*). I performed pollination treatments on experimental flowers in order to evaluate the importance of different visitor guilds to seed set. Next, I identified flower visitors and quantified their visitation rates to wild plants and to plants relocated to the protected Boyce Thompson Arboretum, located near the wild population. I further characterized factors influencing the pollination neighborhood at wild and relocation sites. Important flower visitors included hummingbirds and native halictid bees. The relative frequency of visitation by visitor guilds did not differ between the wild and relocation sites. Seed set results confirmed that the species is highly self-incompatible, and that hummingbird visitation is relatively more important to seed set than is insect visitation, but that both contribute to ultimate total seed counts.

**7) Writing a Draft Recovery Plan for *Echinocereus arizonicus* ssp. *arizonicus***

Principal Investigator(s): **Dr. Marc Baker, private**

Federal Share: \$25,778

Objective(s): Prepare a draft recovery plan for *Echinocereus arizonicus* ssp. *arizonicus*, including all sections: biology, recovery strategy, and recovery actions.

Final Report Abstract: A draft recovery plan was written which will be utilized in the writing of a draft recovery plan that is sent for public comment and ultimately finalized.

**8) Distinguishing Arizona hedgehog cactus from close relatives using genetic information**

Principal Investigator(s): **Dr. Shannon Fehlberg, Desert Botanical Gardens**

Federal Share: \$23,657

Objective(s): The primary goal of this project is to examine genetic relationships between Arizona hedgehog cactus and closely related species in order to provide essential information that will aid in the proper identification of this species and begin to clarify long-standing taxonomic confusion. Specifically, we plan to conduct phylogenetic analysis of red-flowered hedgehog cacti in Arizona (*Echinocereus* section *Triglochidiatus*) using DNA sequences.

Final Report Abstract: Thirty-one populations representing all focal taxa (*E. arizonicus* subsp. *arizonicus*, *E. arizonicus* subsp. *nigrihorridispinus*, *E. coccineus*, *E. santaritensis*, *E. triglochidiatus* var. *mojavensis*, and *E. triglochidiatus* var. *triglochidiatus*) were visited, and 150 spine and/or floral tissue samples were taken. Data for two chloroplast DNA sequence regions and four nuclear microsatellite regions were obtained for a subset of samples and combined with data from a previous *E. arizonicus* subsp. *arizonicus* study (16 populations). Results indicate that there are at least three distinct genetic groups based on shared multilocus haplotypes in this study system: the diploid *E. arizonicus* subspecies, the diploid *E. triglochidiatus* varieties, and the tetraploid *E. coccineus* and *E. santaritensis*, and there is some level of genetic differentiation among populations and taxa. Although these results should be considered preliminary because of their limited scope, they do provide evidence that continued genetic investigations hold promise for resolution of the difficult relationships among red-flowered hedgehog cacti, *Echinocereus* section *Triglochidiatus*.